Effects of level of canola meal on morphology of thyroid gland in broiler chicks

M. Adibmoradi* and G. Pedram

¹Faculty of Veterinary Medicine, Department of Basic Sciences, university of Tehran, Tehran, Iran,: <u>mmadib2000@yahoo.com</u>

The present study performed to examine canola meal on morphology of thyroid gland in broiler chicks. In this experiment 300 1-d-old unsexed Ross broiler chicks assigned into 5 groups. The chicks were fed by five level of canola meal (0, 5, 10, 15 and 20%). Chickens fed from each day 1 to 42. After 42 days four chicks from each pen killed and their thyroid glands removed and immediately were immersed in formaldehyde, before fixation in Bouin's solution and paraffin embedding. Each sample was then sectioned at a thickness of 7 μ m, stained with haemetoxylin and eosin, and examined by light microscopy. Measurements of diameter of follicles, epithelial cell number and epithelial cell height in all groups were made at 100 to 400x magnification. Diameter of follicles, epithelial cell number and epithelial cell height in treatment groups (treatments 3, 4 & 5) were significantly increased as compared with control group (treatment 1) (p<0.01). These results shown that although glucosinolates in canola or double-zero rapeseed is very low, but canola meal can be affected on morphology of thyroid gland in broiler.

Keywords: canola; morphology; broiler; thyroid

Introduction

The protein content of rapeseed meal is about 35-40% and has a physiologically suitable amino acid combination (Henkel and Mosenthin, 1989). However, rapeseed meal contains nutritionally unfavorable substances such as glucosinolates, sinapin, tannin and phytate. Glucosinolates and their hydrolytic products are commonly referred to as goitrogens. Researchers classified the rapeseed meal based on their glucosinolates content. Four categories have been identified as very low, low, medium and high glucosinolate rapeseed meal for 1-5, 10-25, 30-55 and over 55 µmoles/g of fat-free meal, respectively (Mawson et al., 1993). The name canola was adopted for the low erucic acid and low glucosinolates varieties of rapeseed in 1979. By definition Canola seeds contain less than 2% erucic acid and less than 30 µmoles glucosinolates in its defatted meal. Glucosinolates are hydrolyzed by myrosinase (Ciska and Kozlowska, 1998). Myrosinase activity has been observed in gastro-intestinal bacteria of several animal species and poultry (Zeb, 1998). Presence of glucosinolates in the diets leads to hypothyroidism in animals and poultry, reducing the level of thyroid hormones and alters the ratio between triiodothyronine (T3) and thyroxin (T4) in blood. Enlarged thyroid size, increased thyroid stimulating hormone levels, reduced thyroid hormones and changed activities of liver enzymes in the blood of poultry fed diets containing rapeseed meal has been observed (Schöne et al., 1993, Taraz et al., 2006, Kermanshahi and AbbasiPour, 2006).

The present study was conducted to investigate the effects of canola (with low erucic acid and low glucosinolates) on diameter of follicles, epithelial cell number and epithelial cell height in thyroid gland.

Materials and methods

Three hundreds one-day-old commercial unsexed broiler chicks of the Ross strain were placed in restricted area and assigned randomly to each of 20 floor pens. The experiment comprised 5 treatments in a completely randomized design (four replicates per treatment). Canola meal at 5 levels was used in this experiment. The diets contained 0, 5, 15, 20 and 25% canola meal and were formulated to meet the nutrient requirements as Ross guideline.

At 42 days of age, 4 unsexed chicks per replicate pen were randomly sampled for thyroid gland analysis, and then killed. The thyroid gland was removed immediately. The thyroid gland samples were collected with maximum 0.5 cm thickness by autopsy and were fixed in 10% formalin saline. The samples processed by routine method for paraffin embedding. Sections were cut at 5-6 μ m, stained by H&E and examined under light microscope. Histological examinations were carried out according to the method of Iji et al., 2001. Data on diameter of follicles, epithelial cell number and epithelial cell height were analyzed through ANOVA by SAS package and mean of different treatment were compared by least square means test.

Results and discussion

The thyroid gland with T3, T4 and calcitonin secretion has an important role in metabolism and maintenance of Ca⁺⁺ and any factor that make changes in structure and hormones section of thyroid may affected body metabolism. The capsule of thyroid gland consists at loose collagenous tissue. Similar connective tissue septa support the organ. The structural unit of the thyroid gland is the thyroid follicle. Follicles hollow spheres whose size depends upon the activity lining cells. The center of each follicle is filled with a gel-like material called colloid, the storage form of follicular epithelial secretions. Follicular activity is inversely proportional to the diameter of the follicle (Aughey and Frye., 2001). In present project, the effect of various level of canola meal on morphology of thyroid gland in broiler chicks, were studied.

The effects of canola meal on diameter of follicles, epithelial cell number and epithelial cell height in thyroid gland of experimental birds are shown in table 1. Results of experiment indicated that epithelial cell number in thyroid tissue increased incrementally as the level of canola meal inclusion was increased, however, at 5% inclusion of canola meal did not affect (p<0.01) on epithelial cell number. The different levels of canola meal increased follicles diameter in thyroid tissue and highest diameter observed in treatment 5 (20% canola meal). Canola meal inclusion at 5% did not affect on follicle diameter. Epithelium height of follicle, on the other hand, increased significantly when canola meal was added to the diet at more than 5%.

%	Epithelium height	Follicles	Epithelial
Canola meal	of follicle	diameter	cell number
0	1.72 ^c	54.13 ^b	60.00 ^c
5	1.88 ^c	57.40 ^b	62.33 ^c
10	2.75 ^b	73.40 ^a	90.87 ^b
15	3.18 ^b	76.93 ^a	97.40 ^b
20	3.33 ^a	77.33 ^a	101.20 ^a

Table 1. Effects of levels of canola meal on thyroid tissue of broiler chicks

a-c Means in each column with different superscripts are significantly (p<0.01) different.

Kinal et al., (1990) reported that compared with the control group the chickens on the different rape diets had 35-90% thyroid hypertrophy. Trefny et al., (1989) observed significant increases in the thyroid weight. Trefny et al., (1990) reported from a similar experiment on fowls and turkeys that at the end of finishing thyroid weights of both fowls and turkeys were increased with rapeseed meal diets and iodine supplements had no effect. The hormones triiodothyronin (T3) and thyroxin (T4) can be synthesized by the thyroid gland only when sufficient iodine is supplied in the diet. Iodine ions are removed from the blood against a concentration gradient, oxidized to elemental iodine and inserted

into a tyrosine radical (Karlson, 1969). Isothiocyanates block iodine transport from the blood into the thyroid (Karlson, 1969). Zeb et al., (1998) reported that isothiocyanates compete for the available iodine at the site of thyroxin formation in thyroid gland, resulting in a decreased synthesis of thyroxin. The increased physiological activity resulting from competition for iodine leads to increased thyroid size.

The histometrical results showed that the inclusion of canola meal at more than 5% significantly altered the morphology of the thyroid gland compared with control diet and increased size of thyroid gland. In summary, these feeding trials indicate that inclusion of canola meal into diets at 5% support thyroid gland functions. For higher levels of replacement, further investigations and better quality meals are required.

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